REMARKS

Favorable reconsideration of this application, in light of the following discussion and in view of the present amendment, is respectfully requested.

Claim 9 is cancelled. Claims 1-3, 8, 11-14, 16, 19 and 22 are amended. Claim 24 is added. Claims 1-24 are pending.

I. Objection to the Specification

In the Office Action, at page 2, the specification was objected to. Figures 6A and 7A were described with sufficient accuracy at page 8, paragraph 0047 to page 9, paragraph 0055. Further, the specification is amended in light of the Examiner's comments. Accordingly, withdrawal of the objection to the specification is respectfully requested.

II. Objections to the Claims

In the Office Action, at page 2, claims 8, 9, 11, 16 and 22 were objected to. Claims 8, 11, 16 and 22 are amended in light of the Examiner's comments, and accordingly, withdrawal of the claims objections is respectfully requested.

As to claim 9, the objection to the claim is respectfully traversed. In opposition to the Examiner's assertion that the rotation driving part 30 is not shown having any outputs, the Applicants respectfully submit that in Fig. 2, the rotation driving part 30 is shown with a lead line connecting to encoder 40, indicating that the rotation driving part 30 outputs information to the encoder 40. In addition, at page 6, paragraph 0033, lines 6-9, the specification clarifies that "the rotation driving part 30 has a reference direction, and output information on a phase shift of the transmitting part 10 relative to the reference direction in accordance with the rotation of the rotation driving part 30 to the encoder 40 [emphasis added]". Thus, it is clearly established by both the specification and Fig. 2 that the rotation driving part 30 outputs phase shift information to the encoder 40. Therefore, withdrawal of the objection to claim 9 is respectfully requested.

III. Rejection under 35 U.S.C. § 112

In the Office Action, at page 3, claims 13 and 14 were rejected under 35 U.S.C. § 112, 2nd paragraph as being indefinite. Claims 13 and 14 were amended in light of the Examiner's comments, and accordingly, withdrawal of the § 112, 2nd paragraph rejection is respectfully requested.

II. Rejection under 35 U.S.C. § 102

In the Office Action, at page 4, claims 1, 5, 7, 9-11, 15-20 and 23 were rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 4,309,758 to Halsall et al. This rejection is respectfully traversed because Halsall does not discuss or suggest:

> the beacon comprising:...
>
> an encoder to add phase information regarding rotation of the transmitting part to the light, and
>
> the mobile robot comprising:
>
> a location determiner to determine a location of the mobile robot based on the phase information of the light received by the receiving part,
>
> wherein the rotation driving part outputs information on a phase shift of the transmitting part relative to a reference direction of the rotation driving part of the beacon in accordance with the rotation of the rotation driving part,

as recited in amended independent claim 1.

Further, Halsall does not discuss or suggest:

> wherein the rotation driving part outputs information on a phase shift of the transmitting part relative to a reference direction of the rotation driving part of the beacon in accordance with the rotation of the rotation driving part,

as recited in amended independent claim 16.

Additionally, Halsall does not discuss or suggest:

> a rotation driving part to rotate the transmitting part; and
>
> an encoder to add phase information regarding rotation of the transmitting part,
>
> wherein the rotation driving part outputs information on a phase shift of the transmitting part relative to a reference direction of the rotation driving part of the beacon in accordance with the rotation of the rotation driving part,

as recited in amended independent claim 19.

As a non-limiting example, the present invention according to claim 1, for example, is directed to a robot system including a beacon with a transmitting part to transmit light to determine location and a mobile robot with a receiving part to receive the light. The beacon includes a rotation driving part to rotate the transmitting part, and an encoder to add phase information regarding the rotation of the transmitting part to the light. The mobile robot includes a location determiner to determine the location of the mobile robot based on the phase

information of the light received by the receiving part. The rotation driving part outputs information on a phase shift of the transmitting part relative to a reference direction of the rotation driving part of the beacon in accordance with the rotation of the rotation driving part.

Halsall discusses a driverless vehicle autoguided by light signals and three non-directional detectors. The vehicle is automatically guided toward a predetermined destination by a geometric computation of light signals received by at least three omnidirectional detectors on-board the vehicle. At least three detectors are mounted on the vehicle in a triangular array, and each detector is adapted to receive omnidirectional light signals from at least one fixed station having a known position relative to that of the destination. The beacon includes a collimated light source 29 coupled to a stepping motor 31 and a Gray code disc 32 such that the light source and the code disc rotate in unison. The coded output of Gray code disc 32 corresponds to the direction of the beam of light from the light source 29 of beacons with respect to a selected datum direction. The datum direction is constant for all beacons used in the fiducial array defining a navigable region. The beacons all rotate synchronously in speed and in phase. Additionally, the output of the Gray code disc 32 forms a first input to a light source modulator 33 which has a second input corresponding to the map-reference defining the location of the beacon, and the output of the modulator 33 is fed to the light source 29 to provide coded-data corresponding to the location of the beacon and the direction of the beam of light emitted therefrom.

While Halsall discusses a beacon including a rotation driving part and a Gray code disc 32 which has a coded output corresponding to a direction of a beam of light from light source 29 of each of the beacons and an unmanned vehicle having at least three light sensitive detectors, Halsall does not discuss or suggest that a rotation driving part of the beacon outputs information on a phase shift of a transmitting part of the beacon relative to a reference direction of the rotation driving part of the beacon in accordance with the rotation of the rotation driving part. Specifically, Halsall discusses that the coded output of the Gray code disc 32 corresponds to the direction of the beam of light from source 29 of beacons with respect to a selected datum direction, where the datum direction is constant for all beacons used in the array defining the navigable region. While the Gray code disc 32 does have a coded output corresponding to the direction of the beam of light, Halsall does not discuss or suggest that the rotation driving part itself outputs information on a phase shift of the transmitting part relative to a reference direction of the rotation driving part.

In contrast, in accordance with claim 1 of the present invention, for example, the phase information is specific to each of the beacons as the information on the phase shift of the transmitting part is output relative to the reference direction of the specific rotation driving part. The reference direction for each of the beacons is in accordance with the rotation of the rotation driving part with respect to the encoder for each of the beacons.

In Halsall, the coded output of the Gray code disc 32 corresponds to the direction of the beam of light from source 29 of the beacons with respect to a selected datum direction which is constant for all the beacons used. In the present invention of claim 1, for example, the reference direction is specific to the particular beacon as the reference direction is particular to the rotating driving part of the beacon.

Therefore, as Halsall does not discuss or suggest, "the beacon comprising:...an encoder to add phase information regarding rotation of the transmitting part to the light, and the mobile robot comprising: a location determiner to determine a location of the mobile robot based on the phase information of the light received by the receiving part, wherein the rotation driving part outputs information on a phase shift of the transmitting part relative to a reference direction of the rotation driving part of the beacon in accordance with the rotation of the rotation driving part," as recited in amended independent claim 1 and Halsall does not discuss or suggest, "wherein the rotation driving part outputs information on a phase shift of the transmitting part relative to a reference direction of the rotation driving part of the beacon in accordance with the rotation of the rotation driving part," as recited in amended independent claim 16, claims 1 and 16 patentably distinguish over the reference relied upon. Accordingly, withdrawal of the § 102(b) rejection is respectfully requested.

Claims 5, 7, 10, 11, 15, 17, 18, 20 and 23 depend either directly or indirectly from independent claims 1, 16 and 19 and include all the features of the their respective independent claims, plus additional features that are not discussed or suggested by the reference relied upon. For example, claim 7 recites that, "the beacon has inherent beacon information, and the encoder adds the beacon information and the phase information to the light." Therefore, claims, 7, 10, 11, 15, 17, 18, 20 and 23 patentably distinguish over the reference for at least the reasons noted above. Accordingly, withdrawal of the § 102(b) rejection is respectfully requested.

III. Rejection under 35 U.S.C. § 103

In the Office Action, at page 10, claims 1, 3, 5, 8, 9, 12 and 19-21 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 3,687,556 to Price et al. in view of

European Patent Pub. No. 0 522 200. This rejection is respectfully traversed because the combination of the teachings of Price and EP '200 does not suggest:

> wherein the rotation driving part outputs information on a phase shift of the transmitting part relative to a reference direction of the rotation driving part of the beacon in accordance with the rotation of the rotation driving part,

as recited in amended independent claims 1 and 19.

Price discusses a navigation system that includes a continuously rotating transmitter device for generating a fan-shaped beam signal from a single reference point and monitoring the signal at a position spaced from the reference point with a single detector having a pair of signal receiving members spaced apart a predetermined distance for detecting the passage of the signal sequentially therethrough. Price discusses that the bearing of the observation point may be accurately monitored by modulating the frequency or phase of the infra-red beam in a linearly increasing fashion once during each revolution, thereby providing information which is proportional to the angular position of the beam when it is received, respectively, by the elements 11 and 12. In Price, as the beam passes a fixed geographical reference, the frequency or phase starts to increase in a linear manner, and thus the frequency or phase of the beam is proportional to, and is indicative of, its direction with respect to a fixed geographical reference.

Price does not discuss or suggest that a rotation driving part of the rotatable infra-red laser source outputs information on a phase shift of a transmitting part of the laser source relative to a reference direction of the rotation driving part of the laser source in accordance with the rotation of the rotation driving part. Price discusses that the frequency or phase of the beam is proportional to and is indicative of its direction with respect to a fixed geographical reference, but Price does not suggest that the reference direction is a reference direction of a rotation driving part of the laser source itself.

Further, there is no indication in Price that information is found on a phase shift of the transmitting part relative to the reference direction of the rotation driving part of the laser source 10. Thus, there is no requirement that each of the beacons be specifically positioned with respect to a fixed geographical reference as the information on the phase shift of the transmitting part is relative to the reference direction only of the rotation driving part of the beacon itself. EP '200 does not make up for the deficiencies in Price.

EP '200 discusses a mobile monitoring device for monitoring abnormal conditions in a house or office. EP '200 does not discuss or suggest that a rotation driving part of a beacon

outputs information on a phase shift of a transmitting part of the beacon relative to a reference direction of the rotation driving part in accordance with the rotation of the rotation driving part. EP '200 merely discusses that a mobile robot is able to be remotely controlled, but EP '200 does not make up for the deficiencies in Price. Further, the cited motivation of, "providing an inexpensive location determining method so that reports of abnormal conditions can include the location within the monitored area," is inadequate to suggest combining a mobile monitoring device for detecting a fire or gas leak or intruder with a navigation system in which the bearing of a device having beam receiving elements is monitored by modulating the frequency or phase of an infra-red beam.

Therefore, as the combination of Price and EP '200 does not suggest that "the rotation driving part outputs information on a phase shift of the transmitting part relative to a reference direction of the rotation driving part of the beacon in accordance with the rotation of the rotation driving part," as recited in independent claims 1 and 19, claims 1 and 19 patentably distinguish over the references relied upon. Accordingly, withdrawal of the § 103(a) rejection is respectfully requested.

Claims 3, 5, 8, 12, 20 and 21 depend either directly or indirectly from independent claims 1 and 19 and include all the features of their respective independent claims, plus additional features that are not discussed or suggested by the references relied upon. For example, claim 8 recites that, "the location determiner determines the location of the mobile robot based on a displacement of the mobile robot, and the phase information received by the receiving part." Therefore, claims 3, 5, 8, 12, 20 and 21 patentably distinguish over the references relied upon for at least the reasons noted above. Accordingly, withdrawal of the § 103(a) rejection is respectfully requested.

In the Office Action, at page 14, claims 6 and 14 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Halsall in view of U.S. Patent No. 5,974,348 to Rocks. This rejection is respectfully traversed because the combination of the teachings of Halsall and Rocks does not suggest:

> wherein the rotation driving part outputs information on a phase shift of the transmitting part relative to a reference direction of the rotation driving part of the beacon in accordance with the rotation of the rotation driving part,

as recited in amended independent claim 1.

As discussed above, Halsall does not discuss or suggest all the features of amended independent claim 1. Rocks fails to make up for the deficiencies in Halsall. Therefore, claim 1

patentably distinguishes over the references relied upon. Claims 6 and 14 depend either directly or indirectly from independent claim 1 and include all the features of claim 1, plus additional features that are not discussed or suggested by the references relied upon. For example, claim 6 recites that, "the receiving part further comprising: a conical mirror to reflect light from various directions towards one direction; and a receiver to receive the light reflected from the conical mirror." Therefore, claims 6 and 14 patentably distinguish over the references relied upon for at least the reasons noted above. Accordingly, withdrawal of the § 103(a) rejection is respectfully requested.

IV. Allowable Subject Matter

Applicants are appreciative of the indication by the Examiner that claims 2, 4 and 22, which are objected to, would be allowable if rewritten in independent form. Therefore, claim 2 has been rewritten in independent form. Claims 4 and 22, which ultimately depend from claims 1 and 19, respectively, were not rewritten in independent form as it is believed that the independent claims from which they depend patentably distinguish over the references relied upon.

The Applicants are appreciative of the indication that claim 13 would be allowable if rewritten to overcome the §112, 2nd paragraph rejection and to include the limitations of the base claim. Therefore, claim 13 was rewritten in independent form and amended in light of the Examiner's comments with respect to §112, 2nd paragraph.

V. New Claim

New claim 24 recites:

> The robot system according to claim 12, wherein the at least one mirror is a single sided mirror to reflect an incident light from the transmitting part at a predetermined angle.

Nothing in the references relied upon discusses or suggests such. Therefore, it is respectfully submitted that claim 24 patentably distinguishes over the references relied upon.

Conclusion

In accordance with the foregoing, claim 9 has been cancelled. Claims 1-3, 8, 11-14, 16, 19 and 22 have been amended. Claim 24 has been added. Claims 1-24 are pending and under consideration.

There being no further outstanding objections or rejections, it is submitted that the application is in condition for allowance. An early action to that effect is courteously solicited.

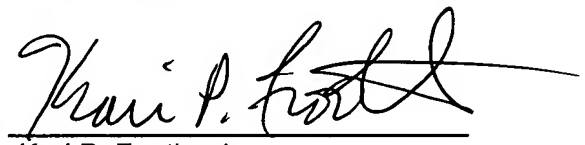
Finally, if there are any formal matters remaining after this response, the Examiner is requested to telephone the undersigned to attend to these matters.

If there are any additional fees associated with filing of this Amendment, please charge the same to our Deposit Account No. 19-3935.

Respectfully submitted,

STAAS & HALSEY LLP

Date: August 30, 2007

By: 

Kari P. Footland
Registration No. 55,187

1201 New York Avenue, NW, 7th Floor
Washington, D.C. 20005
Telephone: (202) 434-1500
Facsimile: (202) 434-1501